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BOTANY.

'Soft roll your incense herbs, and fruits, and flowers,
In mingled clouds to HIM whose sun exalts,
Whose breath perfumes you, and whose pencil paints.'

BOTANY is the science which treats of the vegetable kingdom, including everything that *grows, having root, stem, leaf or flower.* It comprehends the knowledge of the methodical arrangement of plants, of their structure, and whatever has relation to the vegetable kingdom.

The study of this science is not a trifling employment, undeserving the time and attention bestowed upon it. Can we for a moment conceive that the works of nature are unworthy the attention of man—that those productions which bear such evident marks of the wisdom and power of the Creator, are too contemptible for the examination of his creatures? Whoever has had the curiosity to crop the humblest flower of the field, and to observe the wonderful conformation of its parts, combining the united purposes of elegance and utility, will not hastily despise the study of nature. But when these observations are extended through the immense variety of productions which compose the vegetable kingdom—when the different offices of each particular part of the plant, every one essentially contributing towards its existence and propagation, are considered—when we advert to the variety of modes by which these ends are effected, and the infinite contrivance which is exhibited in their accomplishment, a wide field for instruction and admiration is opened before us.

We need not labor to prove how delightful and instructive it is to

'Look through nature up to nature's God;'

neither, surely, need we attempt to show, that if any judicious or improved use is to be made of the natural bodies around us, it must be expected from those who discriminate their kinds and study their properties. Of the benefits of natural science in the improvement of many arts, no one doubts. Our food, our medicine, our luxuries are improved by it. By the inquiries of the curious, new acquisitions are made in remote countries, and our resources of various kinds are augmented. We find that gardening, the most elegant, and agriculture, the most useful of all arts, are improved only in those countries in which Botany is made the most subservient to their advancement. And when a knowledge of this science is more generally diffused throughout our own country, we may expect to see it more frequently enriched with fields and adorned with gardens, which, while they bestow honor on their possessor, shall prove a pleasant recreation to the old, and a useful study to the young. Nor should its influence on the moral character be disregarded. The late President Dwight was an eminent champion of the virtue which he practised. He often directed the attention of his pupils to Sweden, to point out the influence of natural history on the moral character of man. In that country Botany is taught in the schools, and the habitation of her excellent children presents a cheering picture of domestic felicity. Their piety and their patriotism both flow from the same source; for while they examine the productions of their country, they become attached to its soil; and while they contemplate the works of their Maker, they are animated with the glowing spirit of devotion. Botany deserves our highest regard as the source of mental improvement. Nothing so powerfully attracts the attention of the young observer as the gay, though fleeting beauty of flowers; yet these interesting objects serve to produce a true discrimination, which is the foundation of correct taste and sound judgment. To those whose minds and understandings are already formed, this study may be recommended, independently of all other considerations, as a rich source of innocent pleasure. Some people are ever inquiring what is the use of any particular plant? They consider a botanist with respect, only as he may be able to teach them some profitable improvement by which they may quickly grow rich, and be then, perhaps, no longer of any use

to mankind or to themselves. They would permit their children to study Botany, only because it might possibly lead to professorships or some other lucrative preferment. These views are not blameable, but they are not the sole end of human existence. Is it not desirable to call the mind from the feverish agitation of worldly pursuits, to the contemplation of infinite wisdom in the elegant and beautiful economy of nature? Is it not desirable to walk in the garden of creation, and hold converse with the All-ruling Providence? If such elevated feelings do not lead to the study of nature, it cannot be far pursued without rewarding the student by exciting them. The more we study the works of creation, the more wisdom, beauty and harmony become manifest; and while we admire, it is impossible not to adore.

The study of plants may be considered under three general heads.

1. That part of Botany which treats of the different external organs of plants, is called *Vegetable Anatomy*, and in many respects corresponds with the anatomy of animals.

2. The classification of plants by means of comparing their different organs, is termed *Systematic Botany.*

3. The knowledge of the relations and uses of the various parts of plants with respect to each other, is termed *Physiological Botany.* This department, strictly speaking, includes Vegetable Anatomy.

Systematic Botany is divided into the *Natural* and *Artificial Methods.*

The *Natural Method* of plants adopted by Jussieu, is founded on the agreement of general marks and habits, and mostly in medicinal properties, and are called *Natural Orders.* For example, the hop, hemp, fig, mulberry and others have a general agreement in the organization of their flowers, and of their medicinal properties, and are of the natural order *Urticae.* If the whole of the vegetable kingdom could thus be distributed into natural classes, the study of Botany would be much simplified; but there are many plants which cannot be thus arranged, and no principle has yet been discovered for systematic arrangement which bears any comparison to the Artificial System.

Here plants may be conveniently arranged, like words in a dictionary, and thus easily found out and referred to their natural classes: no other system exists which can with certainty direct us to these classes.

The artificial method is founded on different circumstances of two organs of the plant, called the pistils and stamens.

Linné, or Linnæus, of Sweden, was the first who discovered that these organs are common to all plants, and essential to their existence. Taking advantage of this fact, he founded his classes and orders on their number, situation and proportion. By this artificial system, plants are brought together which are unlike in their general appearance, as in a dictionary, words of different signification are placed together from the mere circumstance of their agreeing in their initial letters.

Before we can understand this method, we must become familiar with organs of fructification, which are seven in number, viz :—

1. *Calyx.* The outer or lower part of the flower, generally not colored.*

2. *Corolla.* The colored blossom within or above the calyx, composed of one or more leaves, which are called *Petals.*

3. *Stamens.* The organs immediately surrounding or adjoining the central one. Each stamen is composed of two parts; one, long and slender, called the *Filament;* the other part, called the *Anther*, is a kind of mealy or glutinous knob, which, when the flower comes to maturity, opens and throws out a colored dust, called *Pollen.*

4. *Pistil.* The central organ of the flower; this consists of three parts, the top, which is called the *Stigma*, the slender filament which bears the stigma is called the *Style*, and the base is called the *Germ*, which becomes the pericarp and seed.

5. *Pericarp.* The covering of the seed, whether pod, shell, bag or pulpy substance.

6. *Seed.* The essential part containing the rudiment of a new plant.

7. *Receptacle.* The end of the stem where all the other parts of the flower are inserted.

All the known vegetable productions upon the surface of the globe, have been distributed by naturalists into Classes, Orders, Genera, Species and Varieties. The classes are composed of orders, the orders of genera, the genera of species, and the species of varieties. We may attain a clearer idea of them, by comparing them with the general divisions of the inhabitants of the earth. Vegetables resemble man; classes, nations of men; orders, tribes or divisions of nations; genera, the families that compose the tribes; species, individuals of

* In the language of Botany, any part of a plant is not colored when it is green.

which families consist; and varieties, individuals under different appearances.

In order to understand names of the artificial classes and orders, it is important that we should become familiar with the Latin and Greek numerals, a knowledge of which will be found useful in ascertaining the meaning of very many words of our language which are compounded with them. For example;—*uniform*, from Latin *unus*, one, added to form; *biped*, an animal having two feet, from Latin *bis*, double, and *pes*, a foot; *tripetalous*, having a flower consisting of three leaves, from Greek *treis*, three, and *petalon*, a leaf; *quadruped*, an animal having four feet, from Latin *quatuor*, four, and *pes*, a foot; *pentateuch*, the five books of Moses, from Greek *pente*, five, and *teuchos*, a volume; *hexagon*, a figure having six sides and angles, from Greek *hex*, six, and *gonia*, a corner or angle; *decimal*, numbered by ten, from Latin *decem*, ten; *polytheist*, one who believes in a plurality of gods, from Greek *polus*, many, and *theos*, a god; *multiparous*, producing many at a birth, from Latin *multus*, many, and *pario*, to bring forth young. These few examples will show the importance of knowing these numerals; they will serve as a key to the meaning of words which would otherwise require much time in looking for them in a dictionary.

English.	*Latin.*	*Greek.*
One	Unus	Monos single
Two	Bis, double	Dis double
Three	Tres	Treis triple
Four	Quatuor	Tettares
Five	Quinque	Pente
Six	Sex	Ex (*pron.* hex)
Seven	Septem	Epta (*pron.* hepta)
Eight	Octo	Okto
Nine	Novem	Ennea
Ten	Decem	Deka
Eleven	Undecem	Endeka
Twelve	Duodecem	Dodeka
Thirteen	Tredecem	Dekatreis
Fourteen	Quatuordecim	Dekatettares
Fifteen	Quindecim	Dekapente
Sixteen	Sexdecim	Dekaex
Seventeen	Septendecim	Dekaepta
Eighteen	Octodecim	Dekaokto
Nineteen	Novemdecim	Dekaennea
Twenty	Viginti	Eikosi
Many	Multus	Polus

The artificial classes of Linné are founded on the four following circumstances of the stamens:—number, position, relative length and connection. According to this system, all known plants are divided into *twenty-one classes.*

The first twelve classes are named by prefixing Greek numerals expressive of the number of stamens, to *andria;* which is a Greek derivative, used metaphorically for stamens.

CLASSES.

1. *Monandria,* one stamen; as the blite and samphire.
2. *Diandria,* two stamens; as the lilac and sage.
3. *Triandria,* three stamens; as the blue flag and herdsgrass.
4. *Tetrandria,* four stamens; as the plantain and dogwood.
5. *Pentandria,* five stamens; as the ginseng and violet.
6. *Hexandria,* six stamens; as the lily and tulip.
7. *Heptandria,* seven stamens; as the chick winter green and horse chesnut.
8. *Octandria,* eight stamens; as the marsh cranberry and buckwheat.
9. *Enneandria,* nine stamens; as the sassafras and rhubarb.
10. *Decandria,* ten stamens; as the cassia and pink.
11. *Icosandria,* twenty or more stamens inserted on the calyx; as the rose and myrtle.
12. *Polyandria,* many stamens inserted on the receptacle; as the poppy and pond-lily.

The thirteenth and fourteenth classes are named by prefixing Greek numerals, expressive of the number of long stamens, to *dynamia,* which is a Greek derivative, signifying power—importing that the longest stamens are most powerful.

13. *Didynamia,* two stamens longer or more powerful than the other two; as the ground ivy and peppermint.
14. *Tetradynamia,* four stamens longer or more powerful than the other two; as the mustard and radish.

The fifteenth and sixteenth classes are named by prefixing Greek numerals, expressive of the number of parcels into which the stamens are united by their filaments, to the word *adelphia,* which is a Greek derivative used to signify brotherhood.

15. *Monadelphia,* stamens united by their filaments in one set or brotherhood; as the mallows and cotton.
16. *Diadelphia,* two brotherhoods; as the pea and clover.

The seventeenth class is named by prefixing *syn,* a Greek derivative signifying together, to *genesia,* a Greek derivative signifying produced or growing up. The name is intended to signify that the anthers grow up together, or in an united state.

17. *Syngenesia*, five united anthers, flowers compound; as the marygold and golden rod.

The eighteenth class is named by prefixing an abbreviation of *gynia*, a Greek derivative used metaphorically to signify the pistil, to *andria;* as the stamen and pistil are united in this class.

18. *Gynandria*, stamens growing out of the pistils; as the milk weed and dog bane.

The nineteenth and twentieth classes are named by prefixing Greek numerals expressive of the number of plants occupied by the stamens and pistils in order to complete a species, to *œcia*, a Greek derivative signifying a house. The name implies that the stamens and pistils inhabit the same or different tenements.

19. *Monœcia*, stamens and pistils on separate corollas, upon the same plant or house; as the nettle and mulberry.

20. *Diœcia*, stamens and pistils in separate corollas, upon different plants or two houses; as the fig-tree and balm of gilead.

The twenty-first class is named by prefixing *crypto*, a Greek derivative signifying concealed, to *gamia*, a Greek derivative used metaphorically for the strewing of pollen from the anthers upon the stigmas of pistils.

21. *Cryptogamia*, stamens and pistils invisible, or too small to be seen with the naked eye; as the ferns and mosses.

Each class is subdivided into two or more orders. These subdivisions are founded on the number of styles * (or stigmas when styles are wanting,) the covering or nakedness of seeds, the relative lengths of pods, the comparison between disk and ray florets of compound flowers, and the characters of preceding classes.

The orders of the first twelve classes are named by prefixing Greek numerals expressive of the number of pistils, to *gynia*, a Greek derivative used metaphorically for pistil.

Orders.

1. *Monogynia*, one pistil; as the lily and grape vine.
2. *Digynia*, two pistils; as the pink and sweet-william.
3. *Trigynia*, three pistils; as the sumach and poison ivy.
4. *Tetragynia*, four pistils; as the parnassus grass.
5. *Pentagynia*, five pistils; as the chick weed and flax.
6. *Hexagynia*, six pistils; as the sundew.
7. *Heptagynia*, seven pistils; this order is seldom found.
8. *Octogynia*, eight pistils; very rare.

* Style often is used instead of pistil.

9. *Enneagynia*, nine pistils; very rare.
10. *Decagynia*, ten pistils; as the poke-weed.
13. *Polygynia*, eleven or more pistils; as the rose.

The orders of the class Didynamia are but two.

1. *Gymnospermia*, derived from Greek *gymno*, naked, and *spermia*, seed, implying that the seeds are not covered. Having usually four seeds lying in the calyx; as the peppermint.
2. *Angiospermia*, from Greek *angio*, a bag or sack, and *spermia*, seed, implying that the seeds are covered. Seeds numerous in a capsule; as the fox-glove.

The orders of the class Tetradynamia are two, both distinguished by the form of the fruit.

1. *Siliculosa*, fruit, a *silicula*, or roundish pod; as the shepherd's purse.
2. *Siliquosa*, fruit, a *siliqua*, or long pod; as the mustard.

The orders of the classes Monadelphia and Diadelphia, are founded on the number of stamens, that is, on the characters of the first twelve classes, and have the same names as Monandria, &c.

The class Syngenesia has five orders, distinguished by different circumstances of the florets.

1. *Equalis*,* having stamens and pistils *equal*, or in proportion, that is, each floret is perfect, has a stamen, a pistil, and one seed; as the lettuce.
2. *Superflua*, having florets of the disk perfect, and those of the ray containing *only pistils*, which, without stamens, are *superfluous*; as the marygold.
3. *Frustranea*, having florets of the disk perfect, of the ray neutral, or without the stamen or pistil, therefore *frustrated*, or useless; as the sunflower.
4. *Necessaria*,, having florets of the disk staminate, of the ray pistillate, the one *necessary* to the perfection of the other; as the pot marygold.
5. *Segregata*, having florets separated from each other by partial calyxes, or each floret having a perianth; as the elephants-foot.

The orders of the classes of Gynandria, Monœcia and Diœcia, like the Monadelphia and Diadelphia classes, depend on the number of stamens.

The orders of the class Cryptogamia are distributed into six natural families.

1. *Filices* includes all ferns, the fruit is on the back of the leaves.

* The term *Polygamia* is omitted by the authority of Nuttall.

2. *Musci*, mosses.
3. *Hepaticae*, liverworts, or succulent mosses.
4. *Algae*, sea weeds and frog spittle.
5. *Lichenes*, lichens, growing in somewhat circular patches on the barks of old trees, on old wood and on stones.
6. *Fungi*, mushrooms, mould, blight, &c.

A *Species* includes such individuals as agree in certain circumstances of the roots, stems, leaves and inflorescence. We have no reason to suppose that any new species, either of animals or vegetables, have been produced since the creation. We sometimes see *varieties* made by cultivation; the stamens and pistils, from excess of nourishment, expanding into petals. Varieties are also occasioned by strewing the pollen from one species, upon the stigma of another; but these varieties do not produce perfect seed, and therefore cannot re-produce themselves by their seed. The color, taste and size are not considered as marks of specific difference.

A *Genus* comprehends one or more species grouped together on account of some resemblance in situation, proportion, and connection of the organs which constitute the flower.

A remark, which has sometimes been made to the prejudice of the study of Botany, is, that it is a mere nomenclature, tending only to burden the memory with an immense list of names, without imparting any degree of real useful knowledge. But is it a small gratification, or of small importance, to be enabled to distinguish, at first sight, the productions of the vegetable kingdom, and to refer them to their proper classes, families and stations? The disadvantages resulting from the neglect of this study, are seldom more seriously felt than in the perusal of those narratives of voyages and travels, which are now so profusely published. In passing through countries which have seldom been visited, is in the highest degree desirable, that the adventurer should be able to avail himself of the opportunities afforded him, so as to render his labors of substantial service to mankind: but how is this to be effected, unless he be previously furnished with sufficient knowledge to distinguish those natural productions which may be important either to procure or describe? For want of this knowledge, which would enable him to acquaint us in two words with any known plant, and to refer to its proper station every one which is unknown, we have endless descriptions of unknown and surprising vegetables, which either give us no precise idea, or by a long circuitous track, enable us at length to recognize an old and familiar acquaintance. A striking instance of this may be found in the celebrated Kotzebue's

narrative of his banishment to Siberia, in the course of which he discovered a plant which attracted a high degree of admiration, and which he has described at great length as one of the most beautiful flowers he had ever met with. A slight acquaintance with Botany, would have informed him that this plant was already known to most parts of Europe; and the only doubt which remains is, as to the particular species of the plant—a doubt which his description does not after all clear up.

Zoology, though in many respects more interesting than Botany to man as an animated being, and more striking in some of the phenomena which it displays, yet in other points is less pleasing to a tender and delicate mind. In Botany all is elegance and delight. No painful experiments are to be made. Its pleasures spring up under our feet, and, as we pursue them, reward us with health and serene satisfaction. None but the most foolish or depraved could derive anything from it but what is beautiful, or pollute its lovely scenery with unamiable or unhallowed images. Those who do so, either from corrupt taste or malicious design, can be compared only to a fiend entering into the garden of Eden.

MAN.

(Continued from page 43.)

III. Ethiopian Variety. (See Fig. 1.) *Characters.*—The skin and eyes are black; the hair black and woolly; the skull compressed laterally, and elongated towards the front; the forehead low, narrow and slanting; the cheek-bones are prominent; the jaws narrow and projecting; the upper front teeth oblique; the chin recedes. The eyes are prominent; the nose broad, thick, flat, and confused with the extended jaw; the lips, and particularly the upper one, are thick. The knees turn in, in many instances.

All the natives of Africa, not included in the first variety, belong to this.

The striking peculiarities of the African organization, and particularly the great difference between its color and our own, have led many persons to adopt the opinion of Voltaire, who had not a sufficient knowledge of physiology and natural history to determine the question, that the Africans belong to

a distinct species. There is no one character so peculiar and common to the Africans, but is found frequently in the other varieties, and the negroes often want it; and the characters of this variety run by insensible gradations into those of the neighboring races, as will be immediately perceived by comparing together different tribes of this race, as the Foulahs, Jaloffs, Mandingoes, Kaffers and Hottentots, and carefully noting how in these gradational differences they approach to the Moors, New Hollanders, Arabians, Chinese, &c.

Again, great stress has been laid on the fact, that the negroes resemble, more nearly than the Europeans, the monkey tribe; the fear of being drawn into the family, even as distant relations, has, we believe, induced many to place our black brethren in a distinct species; while others have brought forward this approximation to the monkey tribe, with the view of degrading the African below the standard of the human species, and thereby palliating the cruel hardships under which he groans in some of our southern plantations.

It is undoubtedly true, that in many of the points wherein the Ethiopian differs from the Caucasian variety, it comes nearer to the monkeys; but this fact is not very important: if there are varieties of bodily formation among mankind, some one of these must approach nearer to the organization of the monkey than the others; but does this prove that the variety in which the conformity occurs, is less man than the others? The solidungular, or whole-hoofed variety of the common pig is more like the horse than other swine; do we hence infer, that the nature of this animal in general is less porcine, or more like that of the horse, than that of other pigs? The points of difference between the negro and the European do not affect those important characters which separate man in general from the animal world: the erect attitude, the two hands, the slow developement of the body, the use of reason, and consequently perfectibility, are attributes common to both.

That very little importance can be attached to the general observation of the resemblance of the negro and monkey, founded on external appearance, may be clearly inferred from this fact, that the same remark has been made, even by intelligent travellers, of particular people in the other varieties.

Cartwright thought the Eskimaux very like monkeys; he informs us, that walking along Piccadilly one day with two men, I took them into a shop to show them a collection of animals. We had no sooner entered,' than I observed their attention rivetted on a small monkey; and I could perceive

horror most strongly depicted in their countenances. At length the old man turned to me and faultered out—Is that an Eskimau? I must confess that both the color and contour of the countenance had considerable resemblance to the people of their nation. On pointing out several other monkeys of different kinds, they were greatly diverted at the mistake which they had made; but were not well pleased to observe that monkeys resembled their race much more than ours.

Cook calls the people of the island Mallicollo an ape-like nation; and Forster uses the same comparison—The natives of Mallicollo are a small, nimble, slender, ill-favored set of beings, that, of all men I ever saw, border nearest upon the tribe of monkeys. As the characteristic form of the head and features of the negro are just opposite to those of the Eskimaux and native Americans, we must regard these comparisons, which cannot be correct in all the instances, as loose expressions, not meant to be interpreted literally.

Under the Ethiopian variety, as under the Caucasian and Mongolian, are included numerous nations and tribes, distinguished from each other by well-marked modifications of organization and moral qualities. Nothing is more erroneous than the common notion that all Africans have one and the same character. Winterbottom says, as great a variety of features occurs among these people as is to be met with in the nations of Europe; the sloping contracted forehead, small eyes, depressed nose, thick lips, and projecting jaws, with which the African is usually caricatured, are by no means constant traits; on the contrary, almost every gradation of countenance may be met with, from the disgusting picture too commonly drawn of them, to the finest set of European features. Want of animation does not characterize them, and faces are often met with which express the various emotions of the mind with great energy.

The Koromantyns from the Gold Coast are characterized by firmness of body and mind, activity, courage and ferocity; by the greatest fortitude and contempt of death. Mr. Edwards adduces a horrid example of these qualities in a punishment inflicted for revolt. Two of them were hung up alive in chains; one died on the eighth, the other on the ninth day, without having uttered a groan or complaint.

(*To be continued.*)

TERMITES, OR WHITE ANTS.

GRAND DIVISION—*Articulata*, having jointed trunks and limbs. CLASS—*Insecta*, comprising insects. ORDER—*Neuroptera*, having nervous wings. GENUS—*Termes*, building their nests on the boughs of trees.

—

'Here too all forms of social union find,
And hence let reason late instruct mankind;
Here subterranean works and cities see;
There towns aerial on the waving tree.
Learn each small people's genius, policies,
The ant's republic and the realm of bees;
How those in common all their wealth bestow,
And anarchy without confusion know;
And these forever, though a monarchy reign,
Their sep'rate cells and properties maintain.
Mark what unvaried laws preserve each state,
Laws wise as nature, and as fixed as fate.'

—

THE ant has attracted the notice, and has been celebrated from the earliest ages, both by sacred and profane writers, as a pattern of prudence, foresight, wisdom and diligence. Love and courage, patience and perseverance, almost all the higher virtues of human nature when arrived at the summit of earthly perfection, seem to be the ordinary springs of action in the ant. We have the precept of the wise man—'*Go to the ant, thou sluggard, consider her ways and be wise; which, having neither captain, overseer or ruler, prepares her bread in the summer, and gathers her food in the harvest.*' Implying that the ant, with commendable prudence and foresight, makes use of proper seasons to collect a supply of provision sufficient for her purposes; and that the indolent and slothful should refrain from idleness, and in seasonable time provide for their future wants.

In reading what the ancients say in treating of the ants, we must be careful, however, to separate truth from error, or we shall attribute more to ants than of right belongs to them. Who does not smile when he reads the account of ants given by Pliny, that emulate the wolf in size, the dog in shape, the lion in feet, and the leopard in skin; ants whose employment is to mine for gold, and from whose vengeance the furtive Indian is constrained to fly on the swift camel's back? But when we find the writers of all nations and ages agreeing in the same points, we feel disposed to give larger credit to an assertion which, at first sight, seems to savor more of fact than of fable, and does not attribute more sagacity and foresight to

these insects than in other instances they are found to possess.

There are several genera of ants, the history of which is exceedingly interesting and instructive. But we shall at present treat of the genus *Termes*, which contains the white ants, of which there are several species, all resembling each other in form, in the manner of living, and in their qualities, but differ as much as birds in the manner of building their habitations, and in the choice of the material of which they compose them.

The majority of these animals are natives of the torrid zone, though two species are indigenous to the temperate zones. Their societies consist of five different descriptions of individuals—workers or larvæ, nymphs or pupæ, neuters or soldiers, males and females.

Of the Workers. (See Fig. 2.) The workers are distinguished from the soldiers by their diminutive size, by their round heads and shorter mandibles, being nearly a quarter of an inch in length. If their formidable jaws be examined, and their immense industry and activity be considered, the effects resulting from the labors of myriads of these insects will scarcely excite surprise. The workers bear the same relation as neuters of bees, and are the most numerous, and at the same time most active part of the community, upon which devolves the office of erecting and repairing the buildings, collecting provision, attending upon the female, conveying the eggs to the nurseries, and feeding the young larvæ till they are old enough to take care of themselves.

Of the Nymphs. These were not noticed by Smeathman, who mistook the neuters for them. They differ in nothing from the larvæ, and probably are equally active, except that they have rudiments of wings, or rather the wings folded up in cases. They were also observed by Hooker, who mistook them for a different kind of larvæ. They were first observed by Latreille.

Of the Neuters, or Soldiers. (See Fig. 3.) These are much less numerous than the workers, bearing the proportion of 1 to 100, and exceeding them greatly in bulk. They are also distinguishable by their long and large head, armed with very long awl-shaped mandibles. Their office is that of sentinels; and when the nest is attacked, to them is committed the task of defending it.

Of the Males and Females. (See Fig. 4.) The ants of the third order, which have arrived at their perfect state, the head, thorax and abdomen differ entirely from the others, and

they are furnished with large brown wings. There is only one of each in every separate society, and are strictly king and queen. They are exempted from all participation in the labors and employments occupying the rest of the community, that they may be wholly devoted to the furnishing of constant accessions to the population of the colony. Though at their first disclosure from the pupa they have four wings, they shed them, and appear as represented by Fig. 5.

The commencement of a colony of warlike ants (*Termes fatalis*) takes place as follows: In the evening, soon after the first tornado, which at the latter end of the dry season proclaims the approach of the ensuing rains, these animals, having attained to the perfect state, in which they are furnished and adorned with two pair of wings, emerge from their clay-built citadels by myriads and myriads, to seek their fortune. Borne on their ample wings, and carried by the wind, they fill the air, enter the houses, extinguish the lights, and even sometimes are driven on board the ships that are not far from the shore. The next morning they are discovered covering the surface of the earth and waters, deprived of their wings, which enable them to avoid their numerous enemies, and which are only calculated to carry them a few hours, and appear like large maggots; from the most active, industrious and rapacious, they are now become the most helpless and cowardly beings in nature, and the prey of innumerable enemies, to the smallest of which they make not the least resistance. Insects, especially ants, which are always on the hunt for them, leave no place unexplored; birds, reptiles, beasts, and even man himself, look upon this event as their harvest, and make them their food;* so that scarcely a single pair in many millions get into a place of safety, fulfil the first law of nature, and lay the foundation of a new community. At this time they are seen running upon the ground, the male after the female, and sometimes two chasing one, and contending with great eagerness, regardless of the innumerable dangers that surround them, who shall win the prize.

The workers, which are continually prowling about in their covered ways, occasionally meet with one of these pairs, and, being impelled by their instinct, pay them homage, and they are elected as it were to be a king and queen, or rather father and mother, of a new colony: all that are not so fortunate, inevitably perish; and, considering the infinite host of their

* Mr. Smeathman discoursed with some gentlemen upon the taste of white ants, and on comparing notes, all agreed that they are most delicious and delicate eating. One gentleman compared them to sugared marrow, another to sugared cream and a paste of sweet almonds.

enemies, probably in the course of the following day. The workers, as soon as this election takes place, begin to inclose their new rulers in a small chamber of clay, suited to their size, the entrances to which are only large enough to admit themselves and the neuters, but much too small for the royal pair to pass through;—so that their state of royalty is a state of confinement, and so continues during the remainder of their existence. The impregnation of the female is supposed to take place after this confinement, and she soon begins to furnish the infant colony with new inhabitants. The care of feeding her and her male companion devolves upon the industrious larvæ, which supply them both with everything that they want. As she increases in dimensions, they keep enlarging the cell in which she is detained. When the business of oviposition commences, they take the eggs from the female, and deposit them in the nurseries. Her abdomen now begins gradually to extend, till in process of time it is enlarged to 1500 or 2000 times the size of the rest of her body, and her bulk equals that of 20,000 or 30,000 workers. (See Fig. 6.) This part, often more than three inches in length, is now a vast matrix of eggs, which make long circumvolutions through numberless slender serpentine vessels: it is also remarkable for its peristalic motion, which, like the undulations of water, produces a perpetual and successive rise and fall over the whole surface of the abdomen, and occasions a constant extrusion of eggs, amounting sometimes in old females to sixty in a minute, or eighty thousand and upwards in twenty-four hours. As these females live two years in their perfect state, how astonishing must be the number produced in that time!

This incessant extrusion of eggs must call for the attention of a large number of the workers in the royal chamber, which is always full of them, to take them as they come forth and carry them to the nurseries; in which, when hatched, they are provided with food, and receive every necessary attention till they are able to shift for themselves.—One remarkable circumstance attends the nurseries, that is, they are always covered with a kind of mould, among which arise numerous globules about the size of a small pin's head. This is probably a species of *mucor*, and is conjectured to be the food of the larvæ.

The royal cell has besides, some soldiers in it—a kind of body guard to the royal pair that inhabit it; and the surrounding apartments contain always many both laborers and soldiers in waiting, that they may successively attend upon and defend the common father and mother, on whose safety depend the happiness and even existence of the whole com-

munity ; and whom these faithful subjects never abandon even in the last distress.

The manner in which the Termites feed the young brood, before they commence their active life and are admitted to share in the labors of the nest, probably has never been clearly ascertained.

Of their Habitations. Some of these insects build their nests on the surface of the ground, or partly above and partly beneath—and others on the stems or branches of trees. But by far the most curious, and to which, therefore, we shall confine a minute description, are those formed by the *Termes fatalis*, or, warlike ants, of whose proceedings we have a very particular and interesting account from the pen of Mr. Smeathman.

These nests are formed principally of clay, and are generally twelve feet high and broad in proportion, so that when a cluster of them, as is often the case, are placed together, they may be taken for an Indian village, and are in fact sometimes larger than the huts which the natives inhabit. The first process in the erection of these singular structures, is the elevation of two or three turrets of clay about a foot high, and in shape like a sugar loaf. These, which seem to be the scaffolds of the future building, rapidly increase in number and weight, until at length being widened at the base, joined at the top into one dome, and consolidated all round into a thick wall of clay, they form a building of the size above mentioned, and of the shape of a hay-cock, which when clothed, as it generally soon becomes, with a coating of grass, it at a distance very much resembles. (See Fig. 7.) When the building has assumed this, its final form, the inner turrets, all but the tops, which project like pinnacles from different parts of it, are removed, and the clay employed over again in other services.

It is the lower part alone of the building that is occupied by the inhabitants. The upper portion or dome, which is very strong and solid, is left empty, serving principally as a defence from the vicissitudes of the weather and the attacks of natural or incidental enemies, and to keep up in the lower part a genial warmth and moisture necessary to the hatching of the eggs and cherishing of the young ones. The inhabited portion is occupied by the *royal chamber*, or habitation of the king and queen ; the *nurseries* for the young ; the *storehouses* for food ; and innumerable galleries, passages and empty rooms : arranged according to the following plan :

In the centre of the building, just under the apex, and nearly on a level with the surface of the ground, is placed the royal chamber. (See the section of the hill, Fig. 8.) An arched vault of a semi-oval shape, or not unlike a long oven ; at first not above an inch long, but enlarged as the queen increases in bulk, to the length of eight inches or more. In this apartment the king and queen constantly reside as before observed, and from the smallness of the entrances, which are barely large enough to admit their more diminutive subjects, can never possibly come out ; thus, like many human potentates, purchasing their sovereignty at the dear rate of the sacrifice of liberty. Immediately adjoining the royal chamber, and surrounding it on all sides to the extent of a foot or more, are placed what Mr. Smeathman calls the *royal apartments*, an inextricable labyrinth of innumerable arched rooms of different shapes and sizes, either opening into each other or communicating by common passages, and intended for the accommodation of the soldiers and attendants, of whom many thousands are always in waiting on their royal master and mistress. Next to the royal apartments come the *nurseries* and the *magazines*. The former are invariably occupied by the eggs and young ones, and in the infant state of the nest, are placed close to the royal chamber ; but when the queen's augmented size requires a larger apartment, as well as additional rooms for the increased number of attendants wanted to remove her eggs, the small nurseries are taken to pieces, re-built at a greater distance, a size bigger, and their number increased at the same time. In substance they differ from all other apartments, being formed of particles of wood apparently joined together with gums. A collection of these compact, irregular and small wooden chambers, not one of which is half an inch in width, is inclosed in a common chamber of clay sometimes as big as a child's head.—Intermixed with the nurseries lie the magazines, which are chambers of clay always well stored with provisions, consisting of particles of wood, gums and the inspissated juices of plants.

These magazines and nurseries, separated by small, empty chambers and galleries, which run round them or communicate from one to the other, are continued on all sides to the outer wall of the building, and reach up within it, two-thirds or three-fourths of its length. They do not, however, fill up the whole of the lower part of the hill, but are confined to the sides, leaving an open area in the middle, under the dome, very much resembling the nave of an old cathedral, having its roof supported by three or four very large Gothic arches, of

which those in the middle of the area are sometimes two or three feet high, but as they recede on each side, rapidly diminish, like the arches of aisles in perspective. A flattish roof, imperforated in order to keep out the wet, if the dome should chance to be injured, covers the top of the assemblage of chambers, nurseries, &c.; and the area, which is a short height above the royal chamber, has a flattish floor also water-proof, and so contrived as to let any rain that may chance to get in, run off in the subterraneous passages.

These passages or galleries, which are of an astonishing size, some being above a foot in diameter, and perfectly cylindrical, lined with the same kind of clay of which the hill is composed, served originally, like the catacombs of Paris, as the quarries whence the materials of the building were derived, and afterwards as the grand outlets by which the Termites carry on their depredations at a distance from their habitations. They run in a sloping direction under the bottom of the hill to the depth of three or four feet, and then branching out horizontally on every side, are carried under ground, near to the surface, to a vast distance. At their entrance into the interior they communicate with other smaller galleries, which ascend the inside of the outer shell in a spiral manner, and, winding round the whole building to the top, intersect each other at different heights, opening either immediately into the dome in various places, and into the lower half of the building, or communicating with every part of it by other smaller circular or oval galleries of different diameters. The necessity for the vast size of the main under-ground galleries, evidently arises from the circumstance of their being the great thoroughfares for the inhabitants, by which they fetch their clay, wood, water or provision; and their spiral and gradual ascent is requisite for the easy access of the Termites, which cannot but with great difficulty ascend a perpendicular. To avoid this inconvenience, in the interior vertical parts of the building a flat pathway half an inch wide is often made to wind gradually, like a road cut out of the side of a mountain, by which they travel with great facility up ascents otherwise impracticable. The same ingenious propensity to shorten their labor seems to have given birth to a contrivance still more extraordinary. This is a kind of bridge of one vast arch, sprung from the floor of the area to the upper apartments at the side of the building, which answers the purpose of a flight of stairs, and must shorten the distance exceedingly in transporting the eggs from the royal chamber to the upper nurseries, which in some hills would be four or five feet in the straightest line, and much more if carried through all the winding passages which lead through the inner chambers

and apartments. Mr. Smeathman measured one of these bridges, which was half an inch broad, a quarter of an inch thick, and ten inches long, making the side of an elliptic arch of proportionable size, so that it is wonderful it did not fall over or break by its own weight before they got it joined to the side of the column above. It was strengthened by a small arch at the bottom, and had a hollow or groove all the length of the upper surface, either made purposely for the greater safety of the passengers, or else worn by frequent treading. It is not the least surprising circumstance attending this bridge, the Gothic arches before spoken of, and in general all the arches of the various galleries and apartments, that, as Mr. Smeathman saw every reason for believing, the Termites *project* their arches, and do not, as one would have supposed, excavate them.

Let us pause for a moment and consider what incredible labor and diligence, accompanied by the most unremitting activity and the most unwearied celerity of movement, must be necessary to enable these creatures to accomplish, their size considered, these truly gigantic works. That such diminutive insects, for they are scarcely the fourth of an inch in length, however numerous, should, in the space of three or four years, be able to erect a building twelve feet high and of a proportionable bulk, covered by a vast dome, adorned without by numerous pinnacles and turrets, and sheltering under its ample arch myriads of vaulted apartments of various dimensions, and constructed of different materials—that they should moreover excavate, in different directions, and at different depths, innumerable subterranean roads or tunnels, some twelve or thirteen inches in diameter, or throw an arch of stone over other roads leading from the metropolis into the adjoining country to the distance of several hundred feet—that they should project and finish for them, the vast interior staircases or bridges lately described—and, finally, that the millions necessary to execute such Herculean labors, perpetually passing to and fro, should never interrupt or interfere with each other, is a miracle of nature, or rather the Author of nature, far exceeding the most boasted works and structures of man : for, did these creatures equal him in size, retaining their usual instincts and activity, their buildings would soar to the astonishing height of more than half a mile, and their tunnels would expand to a magnificent cylinder of more than three hundred feet in diameter ; before which the pyramids of Egypt and the aqueducts of Rome would lose all their celebrity, and dwindle into nothings.

(*To be continued.*)

THE CULTURE OF SILK.

'There can no longer remain a doubt that the culture of SILK will become one of the most important branches of our national industry, and like that of Cotton, combine in its favor the triple interests of agriculture, manufactures and commerce. As a product of the soil, it may even claim precedence over that great staple, from the universality of its adaptation to all the various climates embraced within the bounds of the United States. Experiments sufficiently numerous have been made to establish this fact beyond all question; and a zeal has been exhibited in their prosecution and for their extension, evincive of the deep interest which exists in favor of this culture.'

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THE MULBERRY.

NATURAL ORDER—*Urticae*, resembling the nettle in flowers and medicinal properties, being a tonic and anodyne. CLASS—*Monœcia*, stamens and pistils on separate corollas upon the same plant or house. ORDER—*Tetrandria*, having four stamens. GENUS—*Morus*, comprising mulberry trees. Staminate flowers—calyx 4-parted; coral 0. Pistillate flowers—calyx 4-leaved; corol 0; styles 2; calyx berried; seed 1.

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THE mulberry is a woody tree of perennial duration, a native of China and Persia, and was cultivated at a very early period in the western parts of Asia and Europe. The attention there bestowed upon it must have been solely on account of its fruit; for the knowledge of rearing silk worms was confined to Central and Southern Asia till the 6th century. Since that time it has been disseminated throughout all the countries of Europe and America where the education of silk worms has been an object of cultivation.

There are four species of the mulberry, namely, the white mulberry, (*Morus alba*,) black mulberry, (*Morus nigra*,) red mulberry, (*Morus rubra*,) and the many-stalked mulberry, (*Morus multicaulis*.)

The white mulberry puts forth light green leaves of a heart-shaped form longer than they are broad with an oblique base; oval, with the lower end largest; unequally notched round the borders, smoothish; and the green of the under side of the leaf differs from that of the upper, only by being less glossy. Its bark is yellow, and its fruit generally white and insipid; rapid in its growth, producing shoots long and slender.

The leaves of the black mulberry are heart-shaped, wider than they are long; oval, with the lower end largest; unequally toothed; having a thin membranous margin, and cov-

ered underneath with a sort of white down. The bark is of a much darker hue than that of the white mulberry, the fruit generally black and delicious, and puts forth shoots thicker and shorter than the white mulberry, and vegetates more slowly.

The red mulberry puts forth heart-shaped leaves wider than they are long; oval, with the lower end largest, abruptly sharp pointed, the point curved towards one edge of the leaf, having a thin membranous margin, and the under side covered with soft hairs. It is a native of Virginia.

The characters which essentially distinguish the many-stalked mulberry from the other species are those which result, first, from the remarkable property which its roots possess, of throwing up numerous small flexible stalks without forming a principal trunk; secondly, from the great length which these stalks assume in a very short time; thirdly, from the remarkable developement which the thin, slender and soft leaves speedily acquire, and the promptitude with which they are renewed. Their length is often eight inches, and their breadth about six. They are heart-shaped, abruptly sharp pointed, the point curved towards one end of the leaf, toothed towards their summit, marked with nerves and appear curled on the surface; fourthly, and lastly, from the extraordinary facility with which the stalks and young branches strike root, as cuttings, without particular care, even before they have acquired a complete woody consistence.—This last property appears to be caused by the numerous whitish spots with which the stalks and branches are covered; a very apparent characteristic which insures a certain means of identifying the other species, independently of those which we have enumerated.*

The Culture of the Mulberry. The first object of attention to a person contemplating the culture of silk, is to secure an abundant and convenient supply of mulberry leaves, without which he, of course, can do nothing. The supply must be abundant, that he may not from any cause be obliged to stint the worms, at a moment when his whole crop depends upon a full and free supply of food, which is during the last ten days of their feeding; and it must be convenient, that the expense of attendants for gathering leaves may be as small as possible. There are many accidents that may cause the loss of leaves; during a spell of wet weather it is necessary to gather a supply for a day or two a-head, that they may be

* The remaining part of this article is principally from the pen of Mr. G. B. Smith, of Baltimore.

dried before giving them to the worms; these may become spoiled, and thus lost. Therefore if we intend to keep worms enough to consume the leaves of 100 trees, we should always have 150 or 200 trees, and this will be no loss to the proprietor, as ultimately he will find his account in not robbing the trees of their foliage too much, and he will thus be able to favor them in this respect, should he meet with no loss of leaves. It will also be advisable always to have a nursery of young trees for transplanting, to fill vacancies occasioned either by decay or accident in his orchard. In general it may be calculated that a full grown tree will furnish leaves for 5000 worms; therefore a pretty close estimate may be formed of the number wanted. They will require about one third more room than apple trees.

There are several modes of propagating mulberry trees, viz: by *seed*, *cuttings*, *shoots* and *grafts*. The first two I consider the most eligible for this country, though the third is by no means to be rejected where available; for shoots will make tolerable trees. I consider the value of the several modes to be very different, and have set them down in the order in which I estimate them. The seed plant is undoubtedly best, both for food for worms and duration; it is also most convenient, for seed enough can be sent by mail to any part of the union to produce an orchard sufficient to feed several millions of worms. Cuttings in one respect are preferable to seed; they generally save one year in maturing the orchard, but in all other respects they are inferior to seed. It is agreed among horticulturists, that trees propagated by cuttings or shoots, are not as long-lived as those from seed. Cuttings and shoots are difficult of transportation compared with seed; this is the greatest objection. It is unnecessary to dwell on this part of the subject, however, as *convenience* is more worthy of consideration than anything else, and therefore the mode most convenient will of course be adopted.

To propagate the white mulberry one ounce of good seed may be obtained. If all these seeds vegetate, they will produce about 8000 trees. As there is much more *bad seed* for sale than good, care must be taken in selecting it.—Nine-tenths of the seed sold in the United States, is either old, or worthless from some other cause, the most common of which is its being gathered before perfectly ripe. The test of good seed in Europe, is by no means infallible. They put it into cold water, condemning that which floats, and approving that which sinks. In the case of immature seed, this test fails, for if tried while fresh, it is just as heavy as mature seed; and if

the seed be old it fails also, for the specific gravity of old dry seed is less than that of water, and consequently it will float; when at the same time a great part of it will vegetate. If, however, the seed be soaked in ***hot water*** a few hours, what is really good will sink, and the worthless will continue to float; and it may thus be tested, for the good seed alone will swell and sink to the bottom,—whether the bad seed be so from age, premature gathering, or any other cause.

The seed should be planted in a bed, prepared as for lettuce or any other small seed, in a rich, warm soil, where in dry times it will not suffer from drought. It may be sown in drills like lettuce or radishes, and covered quarter or half of an inch deep with fine mould, as early in the spring as the ground and weather will permit, it will come up in 10 to 30 days. The weeds must be destroyed, and in dry times frequent watering will be highly beneficial. Previous to planting, the seeds should be soaked in hot water (not boiling) three or four hours, and then rolled in fine brick-dust, or plaister of paris. The trees will be fit for transplanting into nurseries in the fall, in the middle and southern states, and early the next spring in the northern. Some recommend the summer, when the fruit is ripe, for planting the seed; but I think the spring the best time. After standing in the nursery two years, they may be transplanted into orchards, as other trees are planted, where they are to remain, and leaves may be taken from them after being there one year. I prefer transplanting in the fall, as the small fibrous roots which convey nourishment to the tree, have time to prepare for their functions by the vegetating season next spring. In all cases of transplanting trees, great care should be taken to preserve these very fine roots. The young trees should be pruned as other trees are, when intended for the orchard.

Cuttings may be taken at any time after the fall of the leaf and before the swelling of the buds in spring. They should be those shoots on the limbs of the tree of the last summer's growth that grow perpendicularly, taken carefully off with a saw, including as much of the protuberance of old wood at their base as possible. They may be put in the ground immediately, or kept in dry sand in a dark cellar till the opening of the spring. They will generally be from two to four feet in length, and should be set in an inclined position, about one foot in the ground. In the fall or next spring they may be transplanted into nurseries, and thence treated as seedlings. Suckers may be treated like young trees, as they generally have root enough to sustain them.

Grafting will never be followed in this country, as it is unnecessary for the silk culture, although it is generally practised in Italy; while at the same time Dandolo confesses that the leaves are not so suitable for silk worms as those from seedling trees.

The situation and soil for a mulberry orchard require no other attention than the choice of high ground—that is, a site neither marshy nor bottom land. Although the mulberry requires a warm rich soil for the first year, it is perfectly indifferent as to soil forever afterwards. I have seen the tree in every variety of soil from the poorest to the richest, and have been able to observe no other difference in its foliage than a more firm texture in that on poor land than in that on rich; and this makes a dry stony or even sandy soil preferable to a rich one.

As mulberry seed is getting to be an important article, it is deemed appropriate to give directions here for saving it. When the fruit begins to ripen, every morning the tree should be shaken, and the fruit that falls gathered with that which had fallen before. If enough is not gathered in one morning, several successive gatherings may be collected; but the fruit should not be kept over three or four days, before the seed is extracted; which may be done in the following manner:—Put the fruit into a tub and press and mash it till the berries are completely worked into a common mass. Then pour water into it and stir it briskly, that the pulp may be separated from the seed. Then pour off the water, with all the seed that floats, (as it is worthless,) and renew the washing, till the seed is clean, when it should be drained, spread out on cloths, and dried in the shade. When perfectly dry, it should be put into a tight keg, or other vessel, and kept in a dry place. It should never be exposed to the *light, air, or dampness*, more than is absolutely necessary. The mulberry seed that is *really good, is worth its weight in silver*, as, indeed, it is sold at Mr. Russell's seed store, in Boston, by retail, at a *dollar an ounce*, and we feel certain that the utmost confidence may be placed in it. White mulberry seeds are of an obtuse triangular shape, dull dark yellow color, and very full of oil.

Of the mulberry tree it may be remarked, that there is scarcely any other so tenacious of life.—The coldest weather seems not to affect it, while all attempts to destroy it, when once fairly taken root, by grubbing it up, prove unavailing. Old trees have been cut down twenty or thirty years ago, and yet the old roots continue to throw up numerous shoots every

spring, to the great annoyance of the tidy farmer. The young seedling of six months has a root almost equal to the top, and therefore possesses a great advantage over other trees, for it can be set so firmly in the ground as to be secure from injury by the wind, and obviates the necessity of close pruning. When four years old, it is safe to gather the leaves, which should be done sparingly at first, taking a few from each branch, till the tree has nearly attained its full size; it may then be stripped of two thirds its foliage without injury. Indeed, I have stripped the tree entirely, and the next year it seemed to have a double quantity of foliage, in consequence of the numerous shoots produced by the excessive robbery. The white mulberry always puts out a second crop of foliage after being thus stripped, so that in the fall it exhibits little indication of the robbery in the summer. It is, however, better to economize in gathering the foliage, for the vigor of the tree will undoubtedly ultimately yield to continued excessive deprivation of leaves. Care should always be taken to destroy caterpillars at their first appearance in the spring, otherwise great loss of foliage will be sustained. They are easily destroyed when they first appear; but no efforts are sufficient after a few weeks' quiet possession. When first discovered, the small branch containing the nest should be taken off and burnt; and the work is done.

The Management of Silk Worms. The *fixtures* necessary for raising silk worms are, appropriate tables or shelves, in number and size corresponding with the number of worms to be fed. The best form for shelves that I have seen is that adopted by my friend Mr. J. Y. Tomkins of Baltimore. It is about two and a half feet wide, by five or six feet long, made of thin boards, with a piece two inches wide nailed flat on the upper edge along the sides and ends, with legs about a foot long in the corners. The legs do not pass through the table, but leave a part of the hole on the upper side for the feet of another table to set in. Thus contrived, five or six of these tables are set one above another, and are taken down, cleaned and again set up with facility. One of these shelves will accommodate about 500 worms. The room or laboratory must of course be of a size proportionate to the number of worms raised, and should be provided with windows or other ventilators on the north and south sides at least; and if one or two ventilators are opened in the ceiling, it will be of great service. These ventilators, however, should have shutters that they may be closed at any time when necessary. Fire-places or stoves should also be provided for use when necessary. For the accommodation of 1,000,000 of worms, a room about

80 feet long and 40 wide would be required. A large establishment would also require a ware-room for the deposit of leaves, and this should be large, so that in wet weather the leaves may be shaken and scattered about for the purpose of drying. This room might be advantageously situated above the laboratory. A cool, dark cellar, will also be useful for keeping the leaves fresh in dry weather; white mulberry leaves will thus keep fresh three days; the native mulberry leaves will not keep so long. The number of attendants necessary for 1,000,000 of worms, will be two the first week, four the second, eight the third, and sixteen to twenty the remainder of the feeding season; one half of whom may be children.

At the period for hatching, which is generally about the 1st of May, the eggs, which are presumed to have been kept in the cellar, may be brought out and spread on paper on a common table, called the hatching table. The proper period is always best ascertained by the state of the mulberry leaves. I consider the best and most safe time to be that when the leaves are about the size of a half dollar. The hatching table may be kept in the common laboratory. If the weather be mild and warm, the eggs will begin to hatch in eight or ten days. The first day or two there will but few leave the eggs; they need not be attended to. On the third day a considerable quantity will hatch. Some fresh leaves should then be laid on them, when they will soon attach themselves to the leaves, and should be removed on to a shelf, and be thinly spread out. The next day all that have hatched should be treated in the same way; and so on till they have all hatched, which will generally be in five or six days. Each day's hatching should be placed on separate shelves, and the whole laboratory arranged into as many divisions of shelves as there were day's hatchings, that they may be continually kept separate. This is important, that the periods of moulting and spinning may be as nearly the same with all the worms on a shelf as possible.

In large establishments a small, close room, with a stove, will be very useful in hatching the eggs; as the temperature may be regulated at pleasure. But in this case a thermometer is almost indispensable, as there would be danger of too high a degree of heat, which would spoil the eggs at this season, and the necessary equability and gradual increase of temperature could not be secured without one. In this mode of hatching by artificial heat, the worms will be brought out with more regularity and in less time than in that above described, and therefore it is preferable in large establishments. The hatching room should be, when the eggs are carried into

it, of about 70° temperature, which should be increased one degree a day till the worms are hatched. The hatching room will therefore be of about 80° temperature when the worms are hatched, and if the laboratory is not then about the same temperature, it should be raised to it, or nearly so, before carrying in the young worms, that they may not experience too great and sudden a change.

The leaves may be torn in small pieces whilst the worms are small, and the worms should be fed during the first week, two or three times a day, by scattering the leaves over them. The second week the worms will require food three times a day; the third, fourth and fifth it should be given them as fast as it is either consumed or become withered. The periods of moulting are, generally, about the 7th, 13th, 19th and 24th days of their age; but these periods are materially influenced by the care and attention bestowed on the worms. Some worms will begin to spin on the 25th day, while others will delay their spinning even to 45 or 50 days, according as they are well or ill attended to. At the periods of moulting the worms do not eat, and if they all moult together, no food need be given them; but should they not be thus simultaneous in changing their skins, those which require food should be supplied, even though the others may be disturbed by it. They are about 36 hours shedding their skin.

Every two or three days the shelves should be well cleared of litter and excrement, to effect which the worms may be removed in the following manner:—lay on either large leaves or twigs with leaves, and as soon as the worms attach themselves to them, bear them to a clean shelf; repeat the operation till all are removed. Very few leaves will suffice for the first ten days; a dozen, torn into small pieces will be enough for each shelf, the 1st, 2d, 3d and 4th days; double the quantity the next two days. However, it is unnecessary to attempt estimating the quantity, as the intelligent attendant will readily discover what is necessary, and be able at all times to guard against both stinting the worms and waste of leaves. They should always have as much as they will consume and no more. Great care must be observed that the leaves be perfectly free from wet, and fresh. When they have been kept some time, the leaves begin to turn black or dark colored, and should be thrown away. In wet weather, the leaves may be dried by taking them into a large room, spreading them out, and occasionally shaking them up.

Great care should be taken to guard against mice and ants; mice devour them with avidity, and the bite of an ant is almost instant death to the worm. Insolating the shelves from

the walls and setting the feet in basins of water will protect them from ants; but the access of mice to the room must be cut off.

The success of the crop depends upon the cleanliness of the shelves, and purity of the air in the room, especially in hot, and more particularly in damp weather. If the excrement and litter be allowed to accumulate, fermentation and putrefaction soon commence, and the consequence will be fatal to the worms, especially in hot, damp weather; besides, the worms at all times thrive better when the shelves are kept clean, and nothing but fresh leaves allowed to remain about the worms. To guard against impurity of air, which is the greatest enemy the silk worm has, a small quantity of *chloride of lime* should always be kept in a plate in some part of the room. It is a cheap and most effectual preventive of this cause of disease in worms, as well as a powerful remedy for the *tripes* and other diseases that have become epidemic. It is generally retailed at the drug shops at 25 cents a pound, and four pounds will be sufficient for the largest laboratory. A couple of spoonfuls may be put into a plate with about a gill of water, and should be replenished every three days.

Where proper cleanliness and due attention to ventilation are observed, there is little to be feared from hot weather. Nevertheless, in very hot weather all the means at hand should be availed of for the reduction of the temperature of the room; for worms will thrive best in moderate temperature. But ice, or sprinkling the floor with cold water, should never be resorted to, as has been recommended; for the vapor thus produced will do more injury than the heat. Where convenient, the laboratory should be shaded with high trees on the south side. An open, high piazza to shield the south front of the house from the sun's rays will also be of service. Opening the windows and doors, and the ventilators in the ceiling, will then be all that can be done to cool the room; and this should never be neglected in hot weather. There is much more danger from cold than heat; and on the slightest appearance of a cold night, fire should be made in the fire places or stoves, and replenished as often as necessary. The temperature should be kept as equable as possible, and sudden changes guarded against. For this purpose a thermometer will be very useful; but the senses of the attendant will be a sufficient substitute if care be observed. I do not pretend to give the degrees of temperature most suitable for silk worms; for although we can increase the heat, it is not easy to reduce it in a large room, when the surrounding atmosphere that supplies the air circulating in it, is of a high tem-

perature. It may be observed here, that the cool sensation felt while sitting in a current of air, is no evidence of that air or the place we sit in being of a lower temperature than the air of a room where there is no such current. The air passing over the surface of our bodies carries off heat, and thus causes the cold sensation, while at the same time the current of air, that 'feels cool,' is many degrees warmer than our bodies. But silk worms are not warm blooded animals, and of course they do not experience the same relief, having no excess of animal heat to be carried off. Although many persons have assured me that they had lost many worms by hot weather, I am constrained to think, that the heat was not the sole cause of the loss, for I have never lost a worm that I could attribute to that cause. Hot weather will undoubtedly cause the destruction of the whole of them, if the litter and excrement be left unremoved; and I always suspect some such want of attention in every instance of the destruction of worms by hot weather. Heat does not injure the worms in their natural state, nor will it in their state of domestication, if they are kept as free from filth as they are on their native trees. Keeping the shelves clean, the worms not too much crowded, the air in the room pure by the use of chloride of lime and ventilation, and feeding with fresh dry leaves, I consider the best and only preventives of any ill effects from hot weather.

Between the 25th and 35th days of the worms' age they will show signs of a disposition to spin. They will become somewhat of an amber color about the joints of the body, semi-transparent, throw out fibres of silk on the leaves, and wander about. The *brush* for the cocoons should now be provided. The best and simplest that I have been able to find is the *broom-corn*. Clear it well from seeds, and cut it from the stalk close to the junction of the straws; spread out the top in imitation of a small tree, and set it on the shelf with the top pressing against the bottom of the upper shelf to hold it in its position. It may be set in rows six or eight inches apart, across the shelf, and over the top shelf an extra one may be placed for this purpose. The worms will readily find and climb these little trees and spin their cocoons in them; the worms will be four days spinning their cocoons, and they will all generally be finished on the 8th day after they first began —that is, all of the same day's hatching. The brush may then be taken down, the cocoons taken off, cleared of the loose *tow*, and prepared for reeling.

The cocoons from which eggs are expected must be spread out in a room, secure from mice and ants, and in five to ten days the moths will come out of the cocoons, when the males

and females will couple; they must then be taken by the wings in pairs without separating them, and placed upon sheets of paper disposed for their reception, where they are to remain. There is generally about an equal number of each sex. I have found the best mode for fixing the paper for the moths to lay on, as follows: stretch two pieces of strong twine across the room from wall to wall, about two feet apart, and another about a foot over the middle of these. Lay large sheets of paper (old newspapers will do) over them and pin them down at each side to the lower twine. The sheets of paper will then be in the form of the roof of a house. As many pairs of moths as can conveniently lie on the papers may be placed there. The room should be dark, if possible, while the insects are on the papers, and each sheet should be filled before any are put upon another, and as soon as the moths on one sheet are done laying eggs, it should be taken down, folded, and put into a tin box in a cold cellar, where all the eggs must be kept till wanted for use the next spring.

The moths are in the form of a grayish white butterfly, and generally begin to lay eggs in 24 to 36 hours after leaving the cocoon. The eggs are at first of a pale yellow, or somewhat of a sulphur color, but in three days turn to a light slate color, and subsequently to a dull brownish slate color. When seen through a microscope they are speckled. Those that remain yellow have not been fecundated, and of course are worthless. Each healthy female moth will lay about 450 eggs, generally handsomely disposed and firmly attached to the paper in a circular form, the whole covering a space about the size of a fifty cent piece.

Should the eggs be permitted to remain exposed to the warm weather, they will hatch, and, unless another crop be desired, they will be lost. This is the only injury they are liable to from warm weather. The moths eat nothing after leaving the cocoons, and die in a few days after depositing their eggs. The tin box in which the eggs are directed to be kept, is intended to protect them from mice and insects. The eggs should be kept in a dry cellar, as mould and mildew will injure them. There will be many double cocoons, those which have two or more worms in them; these and as many more of the others as are wanted should be selected for eggs.

After clearing the cocoons of the loose *tow*, such as are intended for reeling, and cannot be wound off immediately, must be subjected to some process by which the chrysalis will be killed, to prevent its perforating the cocoon. Heat is most commonly applied. In Europe the modes of its application are various. Some *bake* the cocoons in an oven about

half heated for bread; others apply steam, and others expose them to the rays of the sun for several days during the heat of the day. There is danger of scorching the silk in the first mode; of discomposing the fibres, in the second; and of not perfectly accomplishing the object in the third. I have found the following mode preferable to any other, as the object is perfectly effected without danger to the silk. I put the cocoons into a tight tin vessel, with a cover closely fitted; and put this vessel into another a little larger, containing such quantity of water as will nearly fill it when the other is put into it; fire is then applied and the water kept boiling half an hour, or more, according to the size of the vessel and until the cocoons in the inner vessel shall have become as hot as the boiling water. The cocoons are then spread out in a dry room, that whatever moisture there may be, may evaporate. After this operation, the cocoons are ready for the reel or for sale. All the cocoons that can be reeled in the course of the first week after they are taken from the brush, may be reeled without this operation; and a considerable advantage is gained by thus reeling them, as they unwind much easier than when they have been heated. Cocoons intended for sale, or keeping on hand for future reeling, must be secured against mice and insects.

Reeling. *To reel the cocoons*, is considered the most difficult part of the duties of a domestic silk cultivator. On the first attempt, the reeler is ready to give it up as too difficult and tedious for his skill and patience. It is at this point where all who give up the business stop; thousands of persons in this country have gone thus far, and after a short trial, abandon the culture of silk in despair. But the difficulty of reeling silk is only in appearance; it is easily overcome, and only requires a little patient perseverance. Many rules have been written for the reeling of silk, but none to much effect. The art lies in *practice*. An expert reeler, in a week's time, would impart more information on the subject to the young reeler, than all the books ever written. But, as we have a ready market for the sale of cocoons, perhaps it would be better for small establishments to dispose of them in that way.

This treatise is not intended particularly for large establishments, but for those who wish to carry on the business in a *small domestic way*. All who have conveniences for raising silk, will not only find it a rich source of innocent amusement, but a laudable and profitable occupation in whatever scale it may be undertaken.

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